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5           The present invention relates generally to voice frame network gatekeepers and intelligent peripherals such as interactive voice response units (IVRs), and more particularly it concerns method and apparatus for interfacing gatekeepers to intelligent peripherals via the ITU H.323 and H.450 standards.

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become more readily apparent from the following detailed description of a preferred embodiment that proceeds with reference to the drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a system block diagram illustrating a voice frame network with a gatekeeper and an intelligent peripheral interfaced in accordance with a preferred embodiment of the invention.

Fig. 2 is a schematic block diagram of the H.323 gatekeeper, intelligent peripheral and gateway architecture in accordance with a preferred embodiment of the invention.

Fig. 3 is a more detailed schematic diagram of the gatekeeper-to-intelligent peripheral interface in accordance with a preferred embodiment of the invention.

Fig. 4 is a flowchart illustrating the interface method in accordance with a preferred embodiment of the invention.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 is a system block diagram of a network 10, i.e. the Internet, with a voice frame network, e.g. an H.323 network, 12 forming a part thereof. A gatekeeper 14 and one or more intelligent peripherals, e.g. interactive voice response units (IVRs), 16a, 16b may be seen to represent two or more nodes within voice frame network 12. Those of skill in the art will appreciate that typically there may be many such voice frame networks such as voice frame network 12 connected to the Internet. Those of skill in the art also will appreciate that typically there may be many such connected gatekeepers and intelligent peripherals such as gatekeeper 14 and IVR 16a.

A public switched telephone network (PSTN) 18 may connect voice traffic from one or more telephones 20 to H.323 network 12 via one or more H.323 gateways (GWs) 22a, 22b, 22c. A customer database 24 is connected to H.323 network 12 to provide needed preferences such as scripts, announcements or other recordings for play out, as will be described. Internet protocol (IP) phones 26 or other H.323 devices may also be connected to H.323 network 12, as shown.

The invented gatekeeper-to-intelligent peripheral interface is indicated generally at 28. Interface 28 will be understood to be implemented preferably in software or firmware, but it may be implemented, within the spirit and scope of the invention, in

hardware. Interface 28 will be understood to span and interconnect--as well as define the behavioral relationship between--gatekeeper 14 and intelligent peripheral 16. Interface 28 accordingly may be implemented as compatible and communicative software modules residing in gatekeeper 14 and IVR 16a, preferably integrated with the software that controls the conventional functions of the gatekeeper and the intelligent peripheral.

Fig. 2 shows H.323 GW 22a terminating the public switched telephone network (PSTN) signaling channel and voice channel and originating H.323 signaling channels 12a, 12b and an RTP/RTCP (voice) stream. Because H.323 gatekeeper 14 does not directly control the voice channel, it is provided with auxiliary means to obtain indirect control of the voice channel via interface 28 to IVR 16a. Importantly, such auxiliary means are compatible with the existing GR-1129-CORE-based standards, and, by extension thereof but without modification, the interface provides for the needed call transfer and other features under the International H.323/H.225./H.245/H.450 standards.

Accordingly, the invented H.323 gatekeeper-intelligent peripheral interface 28 provides full and extensible functionality and compatibility with old and new standards and protocols.

Fig. 3 shows interface apparatus 28 in the form of a more detailed schematic diagram. Gatekeeper 14 may be seen to be interfaced to IVR 16a via interface 28 by inclusion preferably of memory-resident software instructions executed by a processor that forms a part of the gatekeeper and intelligent peripheral. In other words, additional code may readily be installed in the existing base of gatekeepers and intelligent peripherals to render them compatible with the International H.323 standard. The invented apparatus in a preferred embodiment of the invention thus preferably includes a voice frame network connection 12c for coupling gatekeeper 14 to IVR 16a. It further includes protocols (RAS, H.225 + H.450.1 + GR-1129-CORE) over the connection that provides supplemental services messaging between the gatekeeper and the intelligent peripheral, the protocol conveying a REQUEST from the gatekeeper to the intelligent peripheral and a RESPONSE from the intelligent peripheral to the gatekeeper. Finally, it includes a command structure (to be described below) embedded in such request/response protocol, the command structure including a call-transfer request/response sequence to which the gatekeeper is responsive.

Interface apparatus 28 in another preferred form may be thought of as





play-recorded-audio (value '0') and play-recorded-audio-and-await-digital-input (value '1') sequences to which IVR 16a is responsive. Most preferably, conveying step 104 further includes invoking flex-parameter-block (value '4'), play-recorded-audio-and-terminate-call (extended value '101') and play-recorded-audio-using-specified-script (extended value '102') sequences to which IVR 16a is responsive. Those of skill in the art will appreciate that, in accordance with the invention, the protocol and embedded command are realized by in-band signaling, between the gatekeeper and the intelligent peripheral, i.e. signaling or messaging across network connection 12c.

TABLES 2 through 5 immediately below summarize STR signaling between GK 14 and IVR 16a, in accordance with the invention by the use of H.450.1 APDU, which is compatible nevertheless compatible with both ITU H.323 and GR-1129-CORE. TABLES 2-5 are believed to be self-explanatory to those of ordinary skill in the art.

TABLE 2: GK USES FACILITY MESSAGE WHEN A SUBSEQUENCE COMPONENT IS SENT TO H.323 IVR FOR ACTIVE STR-CONNECTION

Information Element	Value	Inclusion Condition
Protocol discriminator	Q.931	Mandatory
Call reference (CR)	CR value = value in SETUP message	Mandatory
Message type	FACILITY	Mandatory
User-to-User		Mandatory
H.450.1 APDU	Invoke component (See Section 5.2.3 of GR-2823-CORE.)	Mandatory for IVR interface

Direction: GK → IVR

TABLE 3: H.323 IVR USES FACILITY MESSAGE FOR SUBSEQUENCE RESULT EXCHANGE WITH GK FOR ACTIVE STR-CONNECTION

Information Element	Value	Inclusion Condition
Protocol discriminator	Q.931	Mandatory
Call reference (CR)	CR value = value in SETUP message	Mandatory
Message type	FACILITY	Mandatory
User-to-User		Mandatory
H.450.1 APDU	Return Result, Return Error, or Reject component (See Section 5.2.3 of GR-2823-CORE.)	Mandatory for IVR interface

Direction: IVR → GK

TABLE 4. H.323 IVR USES RELEASE COMPLETE MESSAGE TO INDICATE IT HAS RELEASED BOTH BEARER AND SIGNALING CHANNELS AND CALL REFERENCE

Information Element	Value	Inclusion Condition
Protocol discriminator	Q.931	Mandatory
Call reference	CR value = value in SETUP message	Mandatory
Message type	RELease COMPlete	Mandatory
Cause (defined in Q.931)	16 = normal clearing (currently not used) 21 = call rejected 65 = bearer capability not implemented	Mandatory
User-to-User		Mandatory
H.450.1 APDU	Return Result, Return Error, or Reject component (See Section 5.2.3 of GR-2823-CORE.)	Mandatory for IVR interface

Direction: IVR  $\rightarrow$  GK

TABLE 5: GK USES SETUP MESSAGE TO ESTABLISH STR-CONNECTION TO H.323 IVR AND REQUEST “sendToResource” OPERATION

Information Element	Value	Inclusion Condition
Protocol discriminator	Q.931	Mandatory
Call reference (CR)	any valid value not in use	Mandatory
Message type	SETUP	Mandatory
Bearer capability	See Section 7.3.10 of H.225.0	Mandatory
User-to-User		Mandatory
H.450.1 APDU	Invoke component (See Section 5.2.3 of GR-2823-CORE.)	Mandatory for IVR interface
Other information elements (Calling party number, Called party number, etc.) as defined in Table 11 of H.225.0	As defined in H.225.0	As required in H.225.0 for Calling Party Number if subscribed to by the IVR

Direction: GK  $\rightarrow$  IVR

10           Setup and clearing of the connection between the GK and the H.323 intelligent peripheral in accordance with the invention will now briefly be described.

If the SETUP message is not acceptable (e.g., the protocol errors and invalid Invoke component), the H.323 intelligent peripheral responds with a RELease COMPLETE message that contains a Return Result, Return Error, or Reject component.

15           A preferred method of clearing a GK initiated STR-connection is to have the GK send a “cancelResource” operation in a FACILITY message to the H.323 intelligent peripheral when the GK receives a Cancel\_Resource\_Event message from the SCP, when the calling user hangs up while the STR-connection is active, or when the GK



application decides to terminate the IVR service due to some error condition. The GK expects the H.323 intelligent peripheral to send a RELease COMplete message when the H.323 intelligent peripheral receives the “cancelResource” operation in a FACILITY message.

- 5           The invoker (GK) uses the return result component described below in TABLE 6 to request an operation from the performer (intelligent peripheral, e.g. IVR).

TABLE 6: INVOKE COMPONENT

Data Element	Value	Inclusion Condition
Component type	Invoke as defined in Section 5.4.1 of GR-2823-CORE for Primary Rate Interface (PRI)	Mandatory
Invoke Identifier	Invoke identifier value = any value not in use. Invoke identifier is defined in Section 5.4.2 of GR-2823-CORE for PRI	Mandatory
Operation value	Use Operation value tag and length for object identifier as defined in Section 5.4.5 of GR-2823-CORE for PRI.	Mandatory
Argument(s)	The possible arguments for “sendToResource” operation are: Resource Type, strParameterBlock and DisplayText. There is no argument for “cancelResource” operation.	Conditional

Direction: GK → IVR

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The IVR uses the return result component described below in TABLE 7 to return results and to indicate that the operation was performed successfully.

TABLE 7: RETURN RESULT COMPONENT

Data element	Value	Inclusion Condition
Component type	Return Result as defined in Section 5.4.1 of GR-2823-CORE for PRI.	Mandatory
Invoke Identifier	Invoke identifier value = value in Invoke component for this component exchange.	Mandatory
Sequence	Sequence is defined in Section 5.4.6 of GR-2823-CORE for PRI.	Conditional (included if any results are returned)
Operation value	Use Operation value tag and length for object identifier as defined in Section 5.4.5 of GR-2823-CORE for PRI.	Conditional (included if any results are returned)
Results	The possible results for “sendToResource” operation are: ReturnBlock	Conditional

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Direction: IVR → GK

The GK and the intelligent peripheral use the return error component described



with a preferred embodiment of the invention, four components are used to request and respond to an operation between the GK and the intelligent peripheral. An operation is defined by its operation value and the arguments associated with the operation.

5 The four components tabulated above in TABLES 6 through 9 will be described in more detail below.

The GK will use an invoke component to begin a new component exchange with the intelligent peripheral. In accordance with invented interface 28, the intelligent peripheral will not initiate a new component exchange with the GK. The invoke component contains a parameter to identify an operation and the arguments needed by  
10 the performer to perform the requested operation.

If the requested operation is performed successfully, the intelligent peripheral will send a return result component in response to the invoke component from the GK (the invoker). The return result component may contain some parameters to be returned to the invoker.

15 The intelligent peripheral will send a return error component to the GK in response to the invoke component if the requested operation cannot be performed. The return error component contains a specific error cause for each situation that indicates the reason for failure. Those of skill in the art will appreciate that, within the spirit and scope of the invention, it may contain other or additional parameters.

20 A Reject component will be sent by the intelligent peripheral to reject a received Invoke component. The components may be rejected for such reasons as protocol violations or unrecognized components or parameters. The reject component preferably contains a parameter that indicates the reason for rejection.

25 The interface 28 command structure is briefly summarized below in TABLE 10.



component preferably contains a parameter that indicates the reason for rejection.

For a STR-connection in the active state, the FACILITY message is also used for the exchange of components over the existing signaling connection. This signaling connection is identified by the call reference value of the corresponding STR-

5 connection. If an STR-connection associated FACILITY message is sent by using a call reference value of an active STR-connection, and this STR-connection is cleared due to STR-connection related causes, then the GK or the intelligent peripheral sends a response within H.450.1 APDU in the first clearing message, i.e., the RELease COMplete message.

10 The GK sends a SETUP message to the intelligent peripheral when the GK requires intelligent peripheral service or the GK application receives a STR message from the SCP. The following script illustrates a valid STR-connection establishment message sequence to the H.323 intelligent peripheral.

#### H.225.0 Call Signaling With GR-1129-Core Extension Script

15 Setup (GK → IVR)

Timeout T303

Setup (GK → IVR)

Call

Proceeding (IVR → GK)

20 Altering (IVR → GK)

Connect (IVR → GK)

Connect Ack (GK → IVR)

25 It will be appreciated that if the H.323 intelligent peripheral does not respond within a predefined time limit, e.g. within timeout T303, then a second SETUP message is sent. The only valid response messages sent by the H.323 intelligent peripheral to an incoming SETUP message are:



Finally, those of skill in the art will appreciate that the invented method and apparatus described and illustrated herein may be implemented in software, firmware or hardware, or any suitable combination thereof. Preferably, the method and apparatus are implemented in software, for purposes of low cost and flexibility. Thus, those of skill in the art will appreciate that the method and apparatus of the invention may be implemented by a computer or microprocessor process in which instructions are executed, the instructions being stored for execution on a computer-readable medium and being executed by any suitable instruction processor. Alternative embodiments are contemplated, however, and are within the spirit and scope of the invention.

Having illustrated and described the principles of my invention in a preferred embodiment thereof, it should be readily apparent to those skilled in the art that the invention can be modified in arrangement and detail without departing from such principles. We claim all modifications coming within the spirit and scope of the accompanying claims.